activity of, *e.g.*, the triceps, muscle can be evoked is separate from (that is to say not the same as) that area whence excitation evokes contraction of the triceps (or of that part of the triceps, inhibition of which is now referred to). On the other hand, the area of the section of the internal capsule, whence inhibition of the muscle is elicited, corresponds with the area whence contraction of its antagonistic muscles can be evoked. Yet synchronous contraction of such pairs of muscles as gastrocnemius and peroneus longus is obtainable from the cortex.

The observations make it clear that "*reciprocal innervation*" in antagonistic muscles is obtainable by excitation of the fibres of the internal capsule. It is probable, therefore, that the inhibition elicitable from the cortex cerebri is not due to an interaction of cortical neurons one with another. The variety of nervous reaction in which I have been able to establish existence of the reciprocal form of muscular co-ordination is now pretty extensive. In some the condition described in the previous (3rd) Note (the state shewn to ensue upon removal of the cerebrum, and in that Note spoken of as "decerebrate rigidity") was conducive to the result; in others the cerebrum was of course not removed. The reactions examined for the phenomenon with positive result include those initiated by excitation of

(1) the skin and skin nerves (with "decerebrate rigidity"),
(2) the muscles and afferent nerves of muscle (with "decerebrate rigidity"),
(3) the dorsal (posterior) columns of the cord (with "decerebrate rigidity"),
(4) of the cerebellum (with "decerebrate rigidity"),
(5) of the crusta cerebri (with "decerebrate rigidity"),
(6) of the internal capsule,
(7) of the optic radiations,
(8) of the Rolandic cortex,
(9) of the occipital (visual) cortex.

C. S. S., *November* 3, 1897.

"On certain Media for the Cultivation of the Bacillus of Tubercle."* By ARTHUR RANSOME, M.D., F.R.S. Received November 13,—Read November 25, 1897.

In May, 1894, a communication was made to the Society by Professor Delepine and myself, "On the Influence of certain Natural Agents on the Virulence of the Tubercle-Bacillus."

* By permission of the Royal College of Physicians, this research, which forms a portion of the Weber-Parkes prize essay, is communicated to the Royal Society before publication. The cost of the inquiry is defrayed by the Thrustan prize, presented to the author this year by Gonville and Caius College, Cambridge.

The conclusions drawn from the experiments recorded in this paper were:—

(1) That finely divided tuberculous matter, such as pure cultures of the bacillus, or tuberculous matter derived from sputum, in daylight and in free currents of air is rapidly deprived of virulence;

(2) That even in the dark, although the action is retarded, fresh air has still some disinfecting influence; and

(3) That in the absence of air, or in confined air, the bacillus retains its power for long periods of time.

These observations afforded an explanation of the immunity of certain places, and the danger of infection in others. They show that where tuberculous sputum is exposed to sufficient light and air, to deprive it of virulence before it can be dried up and powdered into dust, no danger of infection need be dreaded. It would appear further, from this research and others, that it is only when there is sufficient organic material in the air, derived from impure ground air, or from the reek of human bodies, that the tubercle bacillus can retain its existence and its virulent power. Long-lived though it may be under these latter conditions, it is rapidly disinfected by the natural agencies of fresh air and sunlight; so rapidly that, when these agents are present, even in comparatively moderate degree, the tuberculous material cannot reach its dangerous state of dust before it is deprived of all power of doing harm.

But, in addition to the above-mentioned researches, it seemed desirable that an attempt should be made to ascertain what part was played respectively by the several forms of organic impurity that are present in insanitary dwellings. Hitherto, so far as I know, no attempt has been made, in the laboratory or elsewhere, to imitate the actual conditions that prevail in such houses. It was determined, therefore, to collect the aqueous vapours arising from the ground or from human bodies, and to submit these products to the test of trying whether they would serve as cultivating media for the bacillus of tubercle.

Many years ago in a research, the particulars of which are given in an appendix to my treatise on "Stethometry," I examined the condensed aqueous vapour of the breath, in health and disease, and ascertained the quantity of organic matter that it contained. The breath of fifteen healthy persons and of twenty-seven cases of disease was examined chemically by Wanklyn's method of water analysis, and microscopically. The fact of chief importance obtained was, that every specimen contained a small, but appreciable, quantity of both free and organic ammonia. The quantity from the cases of disease varied considerably, but that from healthy persons was remarkably constant, varying from 0·325 milligram to 0·45 per 100 minims of

the fluid collected, the average being 0·4. Hence, by calculation, we obtain the rough estimate that about 3 grs. of organic matter is given off from a man's lungs in the course of twenty-four hours. Doubtless a very small amount, but sufficient to render the aqueous vapour thus thrown off more impure than most sewage water, and ample in quantity, to foster the growth of organic germs.

It was the result of this research that induced me to try to cultivate the bacillus of tubercle upon these and similar organic fluids, such as were likely to be met with in dwelling-houses.

By means of a simple freezing mixture of ice and salt it was easy to condense the aqueous vapour, both of the breath and that coming from ground air; and, in order to make the inquiry more complete, the vapour of the breath was collected in a flask, surrounded by this mixture, from both healthy and diseased sources. In other words, both healthy persons and those affected by phthisis were prevailed upon to breathe into the flask, until a sufficient quantity of aqueous fluid had been obtained.

With another apparatus, consisting of a framework supporting beakers containing freezing mixture, collections of aqueous fluid were obtained from "ground air" coming from a wine cellar in a gravelly subsoil, and from cellars under several low-lying, unsanitary cottages in Southampton. Some of the moisture from a weaving-shed in Blackburn was also thus collected and used as a cultivating medium. The composition of these latter fluids is given below:—

Table I.—Composition of condensed Aqueous Vapours from following sources.

Sources of fluids.	Parts by weight of ammonias per 100,000.		Grains per gallon of ammonias.	
	Free and saline.	Albuminoid.	Free and saline.	Albuminoid.
Healthy breath	1·622	3·568	1·135	2·497
Phthisical breath	0·973	2·598	0·681	1·816
Bournemouth cellar air	0·649	1·622	0·454	1·135
Southampton cellar air.....	2·141	3·893	1·498	2·724
Pure sandy soil	0·020	0·030		
Blackburn weaving sheds (average) (humidified)	0·319	0·082	0·223	0·057
Thames sewage at South Outfall (Keats)	2·309	3·893	1·498	2·724

These several liquids were carefully sterilised by repeated boilings,

and were then used, in various ways, for the cultivation of the bacillus of tubercle.*

Two well-grown specimens of pure cultivations were obtained (both through Dr. Childs), one (A) from the Institute of Preventive Medicine, the other (B) from a private source, but the latter specimen could not be guaranted as human bacillus, it was therefore labelled as of doubtful origin, and the cultivations made with it were kept separate.

In order to test the activity of these cultures they were each, in the first instance, sown upon (*a*) sterilised blood-serum, and (*b*) upon "glycerine agar peptone," as these media were known to be the best for cultivating purposes, and the results could then with advantage be compared with those from the other materials used.

Both specimens were found to be capable of active growth, though the cultivation (A) was somewhat tardy.

Table II.

Media.		Date of inoculation.	Periods of incubation (at 35° C.).			
			2 weeks.	4 weeks.	8 weeks.	12 weeks and upwards.
Blood serum.....	A	April 3	..	×	× ×	× × ×
Agar peptone	A	„ „	..	×	× ×	× × ×
Blood serum.....	B	„ „	× ×	× × ×	× × ×	
Glycerine agar ...	B	„ 13	×	× ×	× × ×	× × ×
Agar peptone	B	„ 3	× ×	× × ×	× × ×	

The crosses denote degrees of growth. One × means the first appearance of a colony. Two × ×, two or more colonies, evidently growing. Three × × ×, growth extending over medium.

It was then thought well, in the first instance, to attempt to cultivate the bacillus upon media, on which it grows with difficulty, without the presence of added peptones; in other words, to find out whether the presence of the condensed organic fluids from the sources that have been mentioned would replace the peptones.

Accordingly, simple agar jelly, with 6 per cent. of glycerine, was made with each of the fluids mentioned, after careful sterilisation. Tubes were charged with these several compounds, inoculated with looped platinum wire, lightly charged, stoppered with sterilised

* The various manipulations required in this inquiry were carried out chiefly by Mr. Tanner, in his Bacteriological Laboratory, at Bournemouth, and to his carefulness and skill much of the success attained is due.

wool, capped, and placed in an incubator, kept at a temperature of 35° C. At the same time, slips of potato, after thorough sterilisation, were soaked in the fluids and inoculated and similarly disposed of.

As a control experiment, the agar jelly was made with simple distilled water and glycerine, charged and disposed of in the same way.

The results of these several experiments are shown on the two following tables. It will be observed that, out of the eighteen specimens, only two (two of those from the impure cellars) failed to produce growth to some extent; those that did best were the fluids from the cellar in porous soil, and those condensed from the breath of phthisical patients. But all kinds of organic fluid showed growth on either agar jelly or potato.

Table III.

No.		Date of inoculation.	Periods of incubation and growth (in incubator at 35° C.).			
			2 weeks.	4 weeks.	8 weeks.	12 weeks and upwards.
	Media:—Agar c 5 per cent. glycerine Condensed vapour from the following sources:—	April 13	..	×	× ×	× ×
1	Cellar in pure porous soil.....	April 3	×	× ×	× × ×	× × ×
2	Ditto	„ „	×	× ×	× × ×	× × × ×
3	Ditto	„ 10	..	..	×	faint
4	Ditto	„ „	..	..	×	„
5	Impure cellar on clay	„ „	..	..	..	blank
6	Ditto	„ „	..	..	..	„
7	Healthy breath.....	„ „	..	×	×	× ×
8	Ditto	„ „	..	×	×	× ×
9	Phthisical breath ...	„ 3	×	× ×	× × ×	× × × } blackened
10	Ditto	„ „	×	× ×	× × ×	× × × }

There is thus some evidence that the organic fluids facilitated cultivation to some extent; experienced bacteriologists, who have attempted to use simple potato or glycerine agar as the cultivating medium, have assured me that failure is much more common than success, and that the growth, when it does take place, is usually very slow. With the organic fluids there were only two failures, and growth was fairly rapid.

Table IV.

No.		Date of inoculation.	Periods of incubation and growth (in incubator at 35° C.).			
			2 weeks.	4 weeks.	8 weeks.	12 weeks and upwards.
	Media:—Sterilised potato, and the vapours as above					
1	From cellar in pure porous soil	April 3	×	× × ×	× × × ×	× × × ×
2	Ditto	,, ,,	×	× ×	× ×	Feeble
3	Impure cellar in clay	,, 10	..	..	× ×	× × ×
4	Ditto	,, ,,	..	..	× ×	× × ×
5	Healthy breath	,, ,,	..	×	× ×	× ×
6	Ditto	,, ,,	..	× ×	× ×	× × ×
7	Phthisical breath ...	,, 3	..	×	× ×	× × ×

In the next series of trials, it was decided to use as the material bases some non-nitrogenous substance, and attempts were made to employ pieces of wood, cork, cotton-wool, and fine spun glass, the last named at the suggestion of a distinguished bacteriologist. None of these bases were found to be satisfactory; and at length it was determined to use a particularly pure "filter-paper," manufactured by Messrs. Schleicher and Schüll, from which even the salts had been extracted by washing with hydrochloric and hydrofluoric acids.* This paper was folded in a convenient form, sterilised, inserted in the test-tubes, and charged with the several organic fluids, to which, as before, 6 per cent. of pure glycerine had been added. It was then inoculated, stoppered as before, and in the first trials these tubes were placed in the incubator at the usual temperature of 35° C.

The results are shown on Table V.

It will be seen that some degree of success was attained in twelve out of fifteen specimens of the organic fluids. The degree of growth was also much the same as in the previous series, though perhaps slightly less vigorous.

* Each of these filter-papers, analysed for me by the Kjeldahl process, by Sir H. Roscoe's assistant, was found to contain only 0·1 milligram of nitrogen.

Table V.

No.		Date of inoculation.	Periods of cultivation (in incubator at 35° C.).				Remarks.
			2 weeks.	4 weeks.	8 weeks.	12 weeks.	
	Media:—Chemically pure filter-paper and condensed fluids ĉ 6 per cent. glycerine.						
	Culture A.						
1	From pure cellar air.....	May 23	..	×	× ×	× ×	
2	„ „ „	„ „	..	×	×	× ×	
3	„ impure cellar air.....	„ „	×	×	× ×	× ×	
4	„ „ „	„ „	×	× ×	× ×	× ×	
5	„ weaver's shed	June 5	..	×	×	×	
6	„ „ „	„ „	..	×	×	× ×	
7	„ healthy breath.....	„ „	..	×	× ×	× ×	
8	„ „ „	„ „	..	×	×	× ×	
9	„ phthisical breath	May 23	×	×	× ×	× × ×	
10	„ „ „	„ „					
11	Distilled water	„ „	..	..	..	..	Medium found to contain free ammonia.
12	„ „	„ „	..	?	..	..	
	Culture B.						
1	Pure cellar air.....	„ „	?	×	× ×	× ×	
2	Impure ditto	„ „					
3	Weaver's shed.....	June 5	?	×	×	× ×	
4	Healthy breath.....	„ „	?	×	× ×	× × ×	
5	Phthisical breath	May 23					
6	Distilled water.....	„ „					

It was now determined to try to do without the help of the glycerine, which, as is well known, so greatly assists the ordinary cultivations of the bacillus. Accordingly, four tubes with simple filter-paper as the supporting medium, and condensed fluids, from the breath of a healthy person, and from that of a phthisical patient, as nutrient fluids, were inoculated, and no glycerine was added. In these tubes the same cultivation was used as in the previous experiments.

Shortly afterwards, two similar tubes with fluid from healthy breath alone, but with 5 per cent. of glycerine, were sown with the same cultivation, and were left at the ordinary temperature of the laboratory, about 21° C. (see Table VI).

All of the former group took on active growth within four weeks, and one of the latter. In other words, it was proved that pure filter-paper, moistened with these condensed fluids, alone would suffice to nourish and promote the growth of the bacillus, and, further, that this growth would take place at ordinary temperatures. It may hence be concluded that when this organic fluid is present in ordinary dwellings, the bacillus may grow at the temperature of living rooms as well as at the temperature of 35° C.

In September, 1896, another attempt to test this point was made by inoculating a dozen more tubes in which the various condensed fluids were employed as nutrients. Some of them were placed in the incubator, the others being placed outside.

In this series, however, a sub-culture on agar peptone, taken from the old Preventive Institute tube, was used as the seed; and it was soon evident that this sub-culture had greatly declined in vigour. For three months no perceptible growth took place on any of the specimens, and then only on phthisical breath to a very slight extent. Although they must be counted for the most part as failures, the results of the inoculations are given in Table VI.

In consequence of this failure in vigour of the last used cultivation, a fresh series of eight tubes was commenced on October 31 with the same cultivation, which also failed.

Then, in February, 1897, through the kindness of Dr. Childs and of Dr. Curtis, a fresh tube of apparently vigorous cultivation of the tubercle bacillus, guaranteed to be of human origin, was obtained from University College, London.

By way of control, this culture was sown upon blood serum and upon agar peptone, and incubated at 37° C., and a copious growth was found to be commencing on the blood serum within ten days time (see Table IX).

Two sets of tubes were then prepared of condensed vapour from breath, and from ground air from a pure sandy soil. No glycerine was added; but for the solid medium, in some instances, the pure

Table VI.

No.		Date of inoculation.	Periods of cultivation.				
			2 weeks.	4 weeks.	8 weeks.	12 weeks.	16 weeks.
	Media :—Pure filter-paper with condensed fluids alone (no glycerine).						
	Culture A.						
	In incubator at 35° C.						
1	Healthy breath	July 21	..	×	× ×	× ×	
2	„ „	„	..	×	×	×	
3	Phthisical breath.....	„	..	×	×	×	
4	„ „	„	×	× ×	× × ×	× × ×	
	Ditto with 5 per cent. glycerine at temperature of laboratory (or about 21° C.).						
1	Healthy breath	„					
2	„ „	„	×	× ×	× ×	× ×	
	Sub-culture from A.						
	Same medium, without glycerine.		1 mnth.	2 mnths.	3 mnths.	4 mnths.	
1	Phthisical breath	Sept. 17	..	..	..	×	×
2	Ditto, 35° C.	„ „					
3	Ditto, ordinary temp...	„ „					
4	Ditto „ „ ..	„ „					
5	Healthy br ath	„ „					
6	Ditto, 35° C.....	„ „					
7	Ditto, ordinary temp...	„ „					
8	Ditto „ „ ..	„ „					
9	Blackburn shed, 35° C.	„ 24					
10	Ditto „	„ „					
11	Ditto, ordinary temp...	„ „					
12	Ditto „ ..	„ „					

filter-paper was employed; in others, an ordinary lining paper, containing a little size, but carefully sterilised, was used.

Some of these were placed in the incubator at a temperature of 37° C., as this higher degree was thought more favourable to growth; others were left in the dark at the ordinary temperature of the laboratory. The results are shown on the following Tables VII and VIII.

Table VII.

No.		Temperature.	Date of inoculation.	Periods of cultivation.				Remarks.
				2 weeks.	4 weeks.	2 months.	3 months.	
	Media:—Pure filter-paper, c following vapours and ½ per cent. gelatine.							
96	Pure ground air	37° C.	Feb. 10	×	× ×	× × ×	× × ×	
97	,, ,,	,,	,,	×	×	× ×	× ×	
100	Healthy breath	,,	,,	×	×	×	× ×	
101	,, ,,	,,	,,					
	Same, without gelatine.							
104	Pure ground air	22	,,	×	×	× ×	× ×	Removed from incubator 9th day.
105	,, ,,	37	,,	× ×	× ×	× ×	× × ×	
106	,, ,,	,,	,,	× ×	× ×	× ×	× × ×	
122	,, ,,	22	Mar. 2	..	×	×	×	Ditto.
123	,, ,,	,,	,,	×	×	×	× ×	Ditto.
124	,, ,,	37	,,	×	× ×	× ×	sent away	
125	,, ,,	,,	,,	×	×	× ×	× ×	
126	,, ,,	,,	,,	×	×	× ×	× ×	
127	,, ,,	,,	,,	×	× ×	× ×	× ×	
128	,, ,,	,,	,,	×	×	× ×	× ×	
116	Healthy breath	22	,,	×	×	×	× ×	
117	,, ,,	37	,,	×	× ×	× ×	× ×	

Table VIII.

No.		Temperature.	Date of inoculation.	Period of cultivation.				Remarks.
				2 weeks.	4 weeks.	2 months.	3 months.	
	Media:—Lining wall-paper, ē vapours and ½ per cent. gelatine.							
98	Pure ground air	37° C.	Feb. 10	×	× ×	× ×	× ×	
99	Ditto	,,	,,	×	× ×	× × ×	× × ×	
102	Healthy breath	,,	,,	× ×	× ×	× ×	× ×	
103	Ditto	,,	,,	× ×	× ×	× ×	× ×	
	Same, without gelatine.							
108	Pure ground air	22	,,	×	× ×	× ×	× ×	Removed from incubator 9th day
107	Ditto	37	,,	× ×	× ×	× ×	× × ×	
109	Ditto	,,	,,	× ×	× ×	× ×	× ×	
110	Ditto	,,	,,	× ×	× ×	× × ×	× × ×	
111	Ditto	,,	,,	× ×	× ×	× ×	× ×	
112	Ditto	22	,,	× ×	× ×	× ×	× ×	Ditto.
129	Ditto	,,	Mar. 2	×	× ×	× ×	sent away	
130	Ditto	,,	,,	×	× ×	× ×	× ×	
134	Ditto	,,	,,	×	× ×	× ×	× × ×	
119	Healthy breath	37	,,	×	× ×	× ×	× ×	
121	Ditto	,,	,,	×	× ×	× ×	× × ×	
118	Ditto	22	,,	..	×	×	× ×	
120	Ditto	,,	,,	×	× ×	× ×	× ×	
131	Pure ground air	37	,,	×	× ×	× × ×	× × ×	
132	Ditto	,,	,,	×	× ×	× ×	× ×	
133	Ditto	,,	,,	×	× ×	× ×	× × ×	
135	Ditto	,,	,,	×	× ×	× × ×	× × ×	

Table IX.—Control Cultivations.

No.	Media.	Temperature.	Date of inoculation.	Periods of cultivation.				Remarks.
				2 weeks.	4 weeks.	2 months.	3 months.	
113	Blood serum	37° C.	Feb. 10	×	× × ×	× × ×	× × ×	
114	Agar peptone	,,	,,	×	×	×	×	
136	Blood serum	,,	Mar. 2	×	× × ×	× × × ×	× × × ×	
137	Ditto	22	,,	..	..	×	×	
138	Agar peptone	37	,,	×	×	×	×	
139	Ditto	22	,,	..	×	×	× ×	
140	Gelatine peptone	,,	,,					
141	Ditto	,,	,,					
142	Potato tubes	37	,,	× ?	×	×	× ×	
143	Ditto	,,	,,	×	× ×	× × ×	× × × ×	
144	Ditto	22	,,	..	×	×	×	
145	Ditto	,,	,,					

It will be seen that in many of the tubes a free growth was observed as early as the end of the first fortnight.

Out of the total number in this series of 37, in thirty-six instances there was free growth on the medium employed, on both kinds of paper, and all kinds of condensed fluid. Eleven of them were grown at a temperature of about 20° C. In only one instance was there complete failure (vapour from healthy breath).

Most of these tubes have been left intact, in order that they may be inspected; but six of them were removed, stained, and examined microscopically, in order to determine whether they were true cultures; this they proved to be.

Two of the cultures, after two months' growth, were sent away to be inoculated into guinea-pigs, but both they and the original culture were found to be non-virulent.*

Microscopic Examination.

Nearly all the earlier cultures, in which there appeared to have been any growth, were submitted to microscopical examination. In all the specimens in which this examination did not show distinct signs of growth the result was put down as "nil," even though a small number of bacilli might have been found. These few bacilli might have come from the inoculation. It was not difficult to recognise the abundant growth of a true cultivation.

These examinations, however, gave remarkable results in a large number of the specimens grown upon paper. Many of the bacilli were gigantic in size, and a considerable number of them showed distinct branching. Others were knobbed at one end or at both ends, when they looked like miniature "life preservers." In many of the specimens the culture seemed to have penetrated into the substance of the paper.

The bearing of these researches upon the subject of the prophylaxis against tuberculosis seems to be of some importance.

They prove that any one of the various organically charged vapours, whether coming from healthy or from diseased lungs, from the air of cellars, or from comparatively pure ground, forms an excellent cultivating medium for the bacillus of tubercle when kept away from the disinfecting influence of air and light.

This power of promoting its growth is particularly manifest when the supporting substance is common wall-paper, though it is quite apparent when very pure filter-paper is used.

It is further proved that, on these substances, the growth of the bacillus may take place at the ordinary temperatures of dwelling-

* A further research, with cultures of the bacillus of undoubted virulence, has now been undertaken.

rooms; and, hence, that there is no safety against the increase of the organism in ordinary living rooms in which active tuberculous dust is present, and in which the natural disinfectants of the bacillus, fresh air and light, are not present in sufficient amount to destroy their virulence.

"Summary of Professor Edgeworth David's Preliminary Report on the Results of the Boring in the Atoll of Funafuti." Communicated by Professor T. G. Bonney, F.R.S., Vice-Chairman of the Coral Reef Boring Committee. Received November 25,—Read November 25, 1897.

The boring at Funafuti, according to the latest advices, had reached a depth of 643 feet. Professor David's report is transcribed from notes made during the progress of the work, and gives his first impressions of the materials brought up, down to a depth of 557 feet, which had been reached when he quitted the island to return to his duties at Sydney, leaving the work in charge of his assistant. The latest advices informed him that the boring was arrested at 643 feet, but as it was hoped this was only for a time, we are daily expecting to hear yet more gratifying news. His last letters, received during the present week, give a few particulars of the materials pierced between 557 and 643 feet. The work, Professor David states, often presented most serious difficulties, which would probably have frustrated their efforts, but for the experience gained on the former occasion.

The bore hole is situated about half a mile N.E. of the Mission Church, and its height above sea level is about 1 foot above high water mark at spring tides. The diameter is 5 inches down to 68 feet; it is lined with 5-inch tubing down to 118 feet, and 4-inch from surface to 520 feet, so that on September 6 a 4-inch core was being obtained.

The following is a general description of the materials pierced:—For about a yard at the top there was a hard coral breccia. This was followed down to a depth of 40 feet by "coral reef rock," into the composition of which *Heliopora cerulea*, with spines of echinids and nullipores, entered largely, the last predominating over the coral at from 15 to 20 feet. From 40 to 200 feet came more or less sandy material, but with a variable quantity of corals. These were scattered through the sand (calcareous and of organic origin; foraminifera, at about 40 feet, making from one-half to two-thirds of the whole) sometimes as fragments (forming occasionally a kind of rubble), but sometimes in the position of growth. Between 120 and 130 feet, and from about 190 to 200 feet, the material